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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/717,303	11/19/2003	James Economy	ILL04-030-US	6472

43320 7590 02/07/2007

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EXAMINER	
STAICOVICI, STEFAN	
ART UNIT	**PAPER NUMBER**
1732	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/07/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/717,303	ECONOMY ET AL.	
	Examiner	Art Unit	
	Stefan Staicovici	1732	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 December 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-13,18-22,24,28,30,31,38 and 39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3, 5-13,18-22,24,28,30,31,38 and 39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicants' amendment filed December 12, 2006 has been entered. Claims 1-3, 5-13, 18-22, 24, 28, 30-31, 38-39 are pending in the instant application.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-3, 5-13 and 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Economy *et al.* (US Patent No. 5,399,377) in view of Spain *et al.* (US Patent No. 5,112,545) and in further view of Johnson (US 2001/0001189).

Economy *et al.* ('377) teach the basic claimed process of making a composite material including, providing a borazine oligomer, providing reinforcing fibers (unidirectional aligned fibers or fabric preform) and mixing said borazine oligomer with said fibers to form a mixture in a mold, heating said mixture at a temperature of 50-90 ^{o}C (first heating) for a time of 48 hours (first heating), further heating said mixture up to a maximum temperature of 400 ^{o}C (second heating), where the molding pressures throughout the process were gradually increased to a maximum pressure of 5 ksi (34

MPa) (at least 15 MPa) and applying a third heating at 1200 ^{O}C (see col. 3, lines 31-51; col. 4, lines 5-56; col. 7, lines 20-21 and col. 8, lines 64-66).

Regarding claims 1-2, although Economy *et al.* ('377) teach in general to apply heat and pressure (see col. 3, lines 31-40), Economy *et al.* ('377) do not specifically teach applying a pressure of at least 0.5 MPa during the first heating. However, applying light pressure to stabilize a resin impregnated preform is well known as evidenced by Spain *et al.* ('545) who teach a process for making a fiber reinforced ceramic composite including, (1) impregnating the preform, (2) applying a slight pressure of 100 psi (about 0.6 MPa) and a low temperature of 300 ^{O}F (about 150 ^{O}C) to pre-rigidize said preform, (3) curing said preform and, (4) firing said preform to form said fiber reinforced ceramic composite (see col. 4, lines 41-64). Therefore, it would have been obvious for one of ordinary skill in the art to provide a slight pressure of 100 psi (about 0.6 MPa) as taught by Spain *et al.* ('545) during the first heating in the process of Economy *et al.* ('377) because Spain *et al.* ('545) specifically teach that a first slight pressure forms a pre-rigidized preform, thereby improving handleability of the preform during further processing (see col. 1, lines 37-43), hence providing for an improved process. Further, it is noted that Economy *et al.* ('377) specifically teach that during the first heating the preform is "partially stabilized" (see col. 4, lines 32-35), thereby suggesting the slight pressure of Spain *et al.* ('545) that results in a "pre-rigidized" preform. It is submitted that a "partially stabilized" preform is a "pre-rigidized" preform.

Further regarding claims 1-2, although Economy *et al.* ('377) in view of Spain *et al.* ('545) teach a boron nitride matrix composite having a density of 1.61 g/cm^3,

Economy *et al.* ('377) in view of Spain *et al.* ('545) do not teach a boron nitride matrix composite having a density of at least 1.62 g/cm^3. However, boron nitride matrix composites having a density of at least 1.62 g/cm^3 are well known as evidenced by Johnson (US 2001/0001189) who specifically teaches a boron nitride matrix composite having a density of over 1.8 g/cm^3 (see ¶¶ 38 and 45). Therefore, it would have been obvious for one of ordinary skill in the art to provide a boron nitride matrix composite having a density of over 1.8 g/cm^3 as taught by Johnson (US 2001/0001189) using the process of Economy *et al.* ('377) in view of Spain *et al.* ('545) because of known advantages that increased density provides such as increased mechanical characteristics, hence providing for an improved product.

In regard to claim 3, Economy *et al.* ('377) teach heating a borazine oligomer at 70 ^{O}C for 30-35 hours (see col. 3, line 66 through col. 4,line 19).

Regarding claim 8, Economy *et al.* ('377) teach a heating rate during the second heating of 30 ^{O}C/hr. (0.5 ^{O}C/min) (see col. 4, line 40).

In regard to claims 5-7 and 9-13, Economy *et al.* ('377) teach heating said mixture at a temperature of 50-90 ^{O}C (first heating temperature) for a time of 48 hours (first heating time), further heating said mixture up to a maximum temperature of 400 ^{O}C (second heating temperature) using a heating rate of 30 ^{O}C/hr. (0.5 ^{O}C/min) (second heating rate), where the molding pressures throughout the process (first and second pressure) were gradually increased to a maximum pressure of 5 ksi (34 MPa) (at least 15 MPa) (first and second pressure) applying a third heating at 1200 ^{O}C (third heating temperature) (see col. 3, lines 31-51; col. 4, lines 5-56; col. 7, lines 20-21 and col. 8, lines

64-66). It is submitted that the first heating temperature, the first heating time, the second heating temperature, the second heating rate and the first and second pressure are result effective variables. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). Therefore, it would have been obvious for one of ordinary skill in the art to have used routine experimentation to determine an optimum level for the first heating temperature, the first heating time, the second heating temperature, the second heating rate and the first and second pressure in the process of Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) because, Economy *et al.* ('377) teaches specific values for said process parameters, hence teaching that said process parameters are result-effective variables.

Specifically regarding claim 18, Johnson (US 2001/0001189) teaches a boron nitride matrix composite having a density of over 1.8 g/cm^3 (see ¶¶ 38 and 45). Therefore, it would have been obvious for one of ordinary skill in the art to provide a boron nitride matrix composite having a density of over 1.8 g/cm^3 as taught by Johnson (US 2001/0001189) using the process of Economy *et al.* ('377) in view of Spain *et al.* ('545) because of known advantages that increased density provides such as increased mechanical characteristics, hence providing for an improved product.

Regarding claim 19, although Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) do not specifically teach the properties of the resulting composite material, it is submitted that, because Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) teach the claimed materials (borazine oligomer and carbon fibers), the

claimed manufacturing process steps, and the claimed density, then the resulting composite material will also posses the claimed properties.

4. Claims 20-22, 28 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Economy *et al.* (US Patent No. 5,399,377) in view of in view of Spain *et al.* (US Patent No. 5,112,545) and in further view of Johnson (US 2001/0001189) and Lavasserie *et al.* (US 2003/0136502 A1).

Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) teach the basic claimed process as described above.

Regarding claim 20, although Economy *et al.* ('377) teach a three dimensional carbon fiber preform (see col. 7, line 21 and col. 8, lines 64-66), Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) do not teach a needled carbon fiber preform. However, needling a fiber preform prior to forming a ceramic matrix composite is well known as evidenced by Lavasserie *et al.* (US 2003/0136502 A1) who teach that it is well known when making a ceramic matrix composite to use a needled preform (see para. [0010]). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a needled preform as taught by Lavasserie *et al.* (US 2003/0136502 A1) in the process of Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) because of known advantages such as improved handleability that allows densification without the need of support tooling, hence providing for a simplified process and also because of its well known status.

In regard to claim 21, Economy *et al.* ('377) teach applying a third heating at 1200 ^{O}C (see col. 3, lines 31-51; col. 4, lines 5-56; col. 7, lines 20-21 and col. 8, lines 64-66).

Specifically regarding claim 22, Economy *et al.* ('377) teach heating a borazine oligomer at 70 ^{O}C for 30-35 hours (see col. 3, line 66 through col. 4,line 19).

Regarding claim 28, Johnson (US 2001/0001189) teaches a boron nitride matrix composite having a density of over 1.8 g/cm^3 (see ¶¶ 38 and 45). Therefore, it would have been obvious for one of ordinary skill in the art to provide a boron nitride matrix composite having a density of over 1.8 g/cm^3 as taught by Johnson (US 2001/0001189) using the process of Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Lavasserie *et al.* (US 2003/0136502 A1) because of known advantages that increased density provides such as increased mechanical characteristics, hence providing for an improved product.

Regarding claim 31, although Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) and Lavasserie *et al.* (US 2003/0136502 A1) do not specifically teach the properties of the resulting composite material, it is submitted that, because Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) and Lavasserie *et al.* (US 2003/0136502 A1) teach the claimed materials (borazine oligomer and carbon fibers), the claimed manufacturing process steps, and the claimed density, then the resulting composite material will also posses the claimed properties.

5. Claim 24, 30 and 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Economy *et al.* (US Patent No. 5,399,377) in view of in view of Spain *et al.* (US Patent No. 5,112,545) and in further view of Johnson (US 2001/0001189), Lavasserie *et al.* (US 2003/0136502 A1) and Parlier *et al.* (US Patent No. 6,284,358 B1).

Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) and Lavasserie *et al.* (US 2003/0136502 A1) teach the basic claimed process as described above.

Regarding claim 24, although Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) and Lavasserie *et al.* (US 2003/0136502 A1) teach a three dimensional carbon fiber needled preform, Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) and Lavasserie *et al.* (US 2003/0136502 A1) do not teach a needled CVI-infiltrated carbon fiber preform. However, CVI consolidation of a fiber preform prior to forming a ceramic matrix composite is well known as evidenced by Parlier *et al.* ('358) who teach that it is well known when making a ceramic matrix composite to use a CVI consolidated preform prior to densification of said preform (see col. 1, lines 23-35 and col. 3, lines 42-60). Therefore, it would have been obvious for one of ordinary skill in the art to have used a CVI infiltration process as taught by Parlier *et al.* ('358) to further consolidate the needled carbon fiber preform in the process of Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Johnson (US 2001/0001189) and Lavasserie *et al.* (US 2003/0136502 A1) because of known advantages such as improved

handleability that allows densification without the need of support tooling, hence providing for a simplified process and also because of its well known status.

In regard to claim 30, Johnson (US 2001/0001189) teaches a boron nitride matrix composite having a density of over 1.8 g/cm^3 (see ¶¶ 38 and 45). Therefore, it would have been obvious for one of ordinary skill in the art to provide a boron nitride matrix composite having a density of over 1.8 g/cm^3 as taught by Johnson (US 2001/0001189) using the process of Economy *et al.* ('377) in view of Spain *et al.* ('545) and in further view of Lavasserie *et al.* (US 2003/0136502 A1) and Parlier *et al.* ('358) because of known advantages that increased density provides such as increased mechanical characteristics, hence providing for an improved product.

Specifically regarding claim 38, Economy *et al.* ('377) teach applying a third heating at 1200 ^{o}C (see col. 3, lines 31-51; col. 4, lines 5-56; col. 7, lines 20-21 and col. 8, lines 64-66).

Regarding claim 39, Economy *et al.* ('377) teach heating a borazine oligomer at 70 ^{o}C for 30-35 hours (see col. 3, line 66 through col. 4,line 19).

Response to Arguments

6. Applicant's arguments filed December 12, 2006 have been considered.

7. Applicants argue that the art of record does not teach or suggest, either alone or in combination, a boron nitride matrix composite having a density of 1.62 g/cm^3 (see pages 6-7 of the amendment filed 12/12/2006). However, this argument is drawn to a newly

presented claim limitation not previously presented that has been rejected in this Office Action as set forth above.

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stefan Staicovici, Ph.D. whose telephone number is (571) 272-1208. The examiner can normally be reached on Monday-Friday 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christina Johnson, can be reached on (571) 272-1176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Stefan Staicovici, PhD

Primary Examiner

AU 1732

February 3, 2007